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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/659,577

09/10/2003

Lawrence T. Drzal

MSU 4.1-588

4666

21036 7590 07/21/2009  
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EXAMINER

NILAND, PATRICK DENNIS

ART UNIT

PAPER NUMBER

1796

MAIL DATE

DELIVERY MODE

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/659,577	<b>Applicant(s)</b> DRZAL ET AL.	
	<b>Examiner</b> Patrick D. Niland	<b>Art Unit</b> 1796	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 01 May 2009.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-4, 7, 8, 10-15, 19, 20, 22, 23 and 25-33 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-4, 7-8, 10-15, 19-20, 22-23, and 25-33 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

#### DETAILED ACTION

1. The amendment of 5/01/09 has been entered. Claims 1-4, 7-8, 10-15, 19-20, 22-23, and 25-33 are pending.

2. The amendment filed 5/10/07 is objected to under 35 U.S.C. 132(a) because it introduces new matter into the disclosure. 35 U.S.C. 132(a) states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: The recitation added to the abstract of “up to five minutes so that there is not significant order between the nanoplatelets compared to a precursor graphite” does not find support for the entirety of the newly recited range, i.e. the full scope of “up to five minutes”, in the originally filed specification nor for “so that there is not significant order between the nanoplatelets compared to a precursor graphite”, even at the sections cited by the applicant. This rejection is maintained for the reasons stated above and the applicant has not distinctly pointed out how the rejection is incorrect nor where to find support for the range discussed above. 3-5 minutes is noted in the originally filed specification but “up to five minutes” is not seen the newly added scope is new matter. This range is clearly broader than 3-5 minutes or any range disclosed in the originally filed specification. Thus, it is unclear what is confusing to the applicant in this regard.

This rejection is based on the amendment to the abstract, not the claims. The amendment to the abstract noted above has not been changed. It remains new matter as stated above. The applicant's arguments are not commensurate in scope with the rejection and the recitation objected to in the abstract amendment of 5/10/07. The applicant's arguments have been fully considered but are not persuasive for the above reasons. This objection is maintained.

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Applicant is required to cancel the new matter in the reply to this Office Action.

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1-4, 7-8, 10-15, 19-20, 22-23, and 25-33 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

A. The newly recited microwaving time of “a few seconds to 5 minutes” is new matter. There is not support for this broad range as it applies to the instant claims in the originally filed specification. Section [0067] is noted. However, this relates only to a particular microwave frequency whereas the instant claims are not limited as is section [0067]. The addition of “a few seconds to 5 minutes” to microwaving at all frequencies with all types of microwaves is new matter for those combinations of time and microwaving parameters not disclosed in the originally filed specification. The applicant’s arguments do not counter this fact. Furthermore, “a few” is not defined in the specification. It is therefore unclear what is intended by “a few”. Matter encompassed by the general meaning of the nebulous “a few” that was not intended by the recitation of “a few” in the specification is also new matter. The applicant’s arguments in this regard have been fully considered but there remains no support for the full scope of the

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recited time range. The newly created scope, e.g. combinations of times and microwaving parameters not disclosed in the originally filed specification, is new matter.

B. The applicant points to figure 4 for basis for the new recitation of “1040 Watts” of claim 31. The figure only shows 1040W at 3 minutes for one specific graphite expansion mixture/process situation. This does not establish using 1040W for all graphitization expansion mixtures and/or process situations. The recited power is therefore new matter as it relates to the entire scope of the instant claims. The newly added scope remains new matter. The applicant’s arguments have been fully considered but are not persuasive for the above reasons. The newly created scope, e.g. combinations of wattage and other microwaving parameters not disclosed in the originally filed specification, is new matter. The applicant’s arguments do not counter this fact. This rejection is maintained.

6. Claims 1-4, 7-8, 10-15, 19-20, 22-23, and 25-33 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

A. The instant claims recite microwaving time of “a few seconds to 5 minutes”. It is unclear what is meant by “a few seconds”. This nebulous language is not defined in the enabling specification. The term "few" in the claims is a relative term which renders the claim indefinite. The term "few" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. The applicant’s arguments have been fully considered but do not remedy the fact of this rejection. This rejection is therefore maintained.

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7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 1-4, 7-8, 10-15, 19, and 29-30 are rejected under 35 U.S.C. 102(b) as being anticipated by US Pat. No. 6024900 Saito et al. with US Pat. No. 6395199 Krassowski et al. and US Pat. No. 4199628 Caines being cited as evidence that the temperatures of Saito give the instantly claimed "worm-like" structure.

Saito discloses a composite having the instantly claimed mixture of polymer and graphite platelets. The heating of Saito is expected to boil off the intercalant and the instantly claimed "worm-like" shape as evidenced by the fact that Krassowski et al., column 5, lines 50-68 and column 6, lines 42-50 and Caines, column 6, line 22 et seq. show that the heating conditions of Saito are expected to give the instantly claimed worm-like shape when such graphite/oxyacid compositions are heated to the temperatures of Saito. It is not seen that the heating means of the instant claims gives a different result than that of the patentee via probative evidence that is commensurate in scope with the instant claims and the cited prior art. Furthermore, the instant claims are silent as to the temperature to which the graphite is heated (it is noted that wattage is not sufficient alone since the layout of the microwave and other particulars thereof affect

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temperature, with microwaves having rotating platforms being a well known instance indicating this fact), which appears to be material to the result of the microwave or radio frequency heating as would be clear to anyone who has ever heated anything with a microwave. No evidence is seen that the claimed method of making the graphite makes the instantly claimed products different from those of the patentee though the processes of making the graphites differ in the form of energy applied to the graphites. It would appear that these different energy forms would lead to the same products, particularly given the lack of specificity of the instant claims in establishing any unobviously different structure between the two graphites. See MPEP 2113. See Saito et al., the abstract, which discloses the instantly claimed composites and their barrier properties and electrical conductivity. The intercalation and heating of column 2, lines 59-65 of the patentee is expected to give the same effect as the instantly claimed microwave or radiofrequency heating since all are forms of energy resulting in heating. The fabrication methods of column 4, lines 49-60 are the fabrication steps of the methods of the instant claims 12-15, 19, and 30. It is not seen that the instant method claims require more steps than the claimed fabrication steps. It is not seen that the method steps relating to making the graphite are required by the instant method claims since they appear to only define the graphite “provided” and are not necessary for the processes of fabricating of these claims. Column 4, lines 37-48 encompass the amounts of the instant claim 2. The exemplified resistivities, such as column 5, lines 38-40, and the conductive nature of the composites of the patentee implies the conductivity of the instant claim 14. The particle sizes of the graphites of the patentee fall within those of the instant claims.

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The above rejection meets the requirements of an anticipation rejection. There is no probative evidence that is commensurate in scope with the instant claims and the cited prior art that the composite of the cited prior art does not fall within the scope of the instant claims. Again MPEP 2113 regarding product by process claims is noted. The rejection appears even more correct now that less time in the microwave is required. The applicant has not demonstrated the argued structure implied by the product by process limitations gives an actual structural difference in a manner commensurate in scope with the instant claims and the cited prior art. There is no showing of any structural difference between the prior art composites and those of the instant claims particularly considering the breadth of the instant claims due to lack of recitation of power applied to the microwaved graphite, temperature the graphite reaches, or any other limitations which specifically affect what happens to the microwaved materials. Furthermore, the claims read on further processing such as grinding as does the prior art cited. No evidence presented by the applicant addresses all of these issues. The examiner sees not structural differences that result from microwaving verses the heating of the cited prior art.

The applicant's arguments of 6/29/06 have previously been considered including the declaration of Lawrence T. Drzal. However, there is no comparison data with the prior art graphites discussed above. Furthermore, the graphites of the referenced dissertation appear to have been treated under very specific conditions as to time and temperatures which are not required of the instant claims nor the prior art cited above. Nor are any of the argued graphite superior properties required of the instant claims. It would appear to be possible to heat graphite to other temperatures for other times at other wattages and obtain the above discussed graphites. The applicant's reference to MPEP 2113 is therefore not persuasive in that it has yet to be



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demonstrated that microwave heating as broadly encompassed by the instant claims and the above cited prior art gives the "implied structure" argued. It would appear that temperature and treatment time would be material to how clean the surface of the graphite gets. This position is therefore maintained.

It remains the examiner's position that the prior art composites fall within the scope of those of the instant claims and that there is not sufficient evidence that the instant claims do not include the prior art composites due to the lack of recitation of parameters important to determining the exact nature of the graphite that results from microwaving verses heating of the cited prior art.

/ It is expected that the intercalation of the reference at the high temperature that is expected to violently flash off the intercalant will necessarily, inherently give some spacing that is within the scope of the instantly claimed "300 times or more" due to the closeness of the graphene sheets in their non-expanded form, the visible expansion giving huge, by comparison to the non-expanded distances, separation of the graphene sheets, that must be 300 times or more for at least some of the expansion. It is noted that the instant specification teaches that not all of the sheets in the sample give this expansion. See paragraph [0069] noted in the applicant's response. See MPEP 2112 regarding inherency.

The 5/1/09 declaration of L. Drzal has been fully considered but is not sufficient to overcome the instant rejections. There is not probative evidence that the high temperatures, e.g. 1000 C, of Saito does not violently flash off the oxidizing acid. While the mechanisms of heat transfer between microwaving and convection are clearly different, both ultimately result in heat. The instant claims do not specify the particulars of the microwaving, such as cavity size, magnetron arrangement, frequency, power, etc. so as to give the time that it takes the microwaved graphite

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of the instant claims to reach whatever temperature it reaches, this temperature also is not specified by the instant claims. The 10 kilowatt microwave of the declaration is therefore not commensurate in scope with the instant claims. It is not seen that the acid vapor merely leaks out at 1000 C and does not escape violently via flashing off. The prior art is not limited to the Asbury Expandable Graphite Grade 3772 of the declaration. It is not seen how differences in intercalated graphites affect the results. The declaration does not show that the graphite expanded by convection heating does not have grapheme sheets that have separated by 300 times in accordance with the instantly claimed invention even if not all of the sheets separate by this amount per the instant application paragraph [0069], which is taken as indicating that not all of the sheets need to separate by 300 times to meet the instantly claimed limitation. If the separation of the closely packed sheets, prior to expansion, is not relatively large, e.g. 300 times or more, it is expected that the bonds holding the sheets in closely packed form may reform.

The applicant's opinion that one would not use microwaves to heat graphite because the graphite is conductive lacks probative support and is merely opinion. The graphite is not as conductive as metal. Metal is routinely excluded from microwaves due to the arcing noted by the declaration. However, metal is used in some microwave containers, such as microwaved pizza cardboard containers, to give browning of the crust. Metals are expected to have lower energies for the electrons therein to escape. The examiner sees no evidence that the energy of microwave photons can cause the electrons in graphite to escape and give arcing. The energy required to get electrons to escape from graphite is relatively easy to measure. It is well known to the extent that I believe the general concept is what Einstein received his Nobel prize for and the examiner did routine experiments in determining the escape potentials for electrons of

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various substrates when bombarded with photons of various frequencies in undergraduate physics lab. Thus, the applicant's assertion that microwaves would be expected to cause arcing in graphite is readily determinable and this determination is not seen in probative form. The applicant's conclusion is therefore not supported by probative evidence. Furthermore, it is not seen that the graphite will spark in the presence of the intercalating agents or would have been expected to spark. The Blain reference cited in the following rejections is also noted as contradicting this opinion. The applicant is further directed to the above discussion that microwaving is not required of the instantly claimed inventions which are directed to composites, articles, and methods of making things with the already formed expanded graphite. It remains unseen that the microwaving makes a different expanded graphite than that of the cited prior art, considering the scope of the instant claims, particularly regarding the lack of microwaving particulars needed to determine the affects of the microwaves on the graphite.

Arguments relating to the related application 11/361255 are not persuasive because the claims therein are not the same as the instant claims. The last four lines of page 18 of the applicant's response is correct and would make the instant claims allowable. However, as stated above, the examiner cannot see that the expansion of the prior art at 1000 C does not give the instantly claimed 300 times expansion for at least some graphene sheets per the instant specification, paragraph [0069], discussed above. The evidence of page 19, first four lines of the applicant's response is not seen, as noted above. Particularly, Blain, cited in the rejection below, column 5, lines 1-7 refutes this idea. Furthermore, it is the examiner's contention that the claims in the instant application do not require the microwaving, as discussed above. There remains no evidence that is commensurate in scope with the instant claims and the cited prior art that a

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cleaner surface results from microwaving. This issue has been argued fully in the entire set of the applicant's applications related to microwave expansion of intercalated graphite. These arguments are maintained here also. Particularly, those relating to the lack of particulars of the microwaving process discussed above are noted here.

The applicant's arguments have been fully considered but are not persuasive for the above reasons. This rejection is maintained.

10. Claims 1-4, 7-8, 10-15, 19, and 29-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Pat. No. 6024900 Saito et al. with US Pat. No. 6395199 Krassowski et al. and US Pat. No. 4199628 Caines being cited as evidence that the temperatures of Saito give the instantly claimed "worm-like" structure.

Saito discloses a composite having the instantly claimed mixture of polymer and graphite platelets. The heating of Saito is expected to boil off the intercalant and the instantly claimed "worm-like" shape as evidenced by the fact that Krassowski et al., column 5, lines 50-68 and column 6, lines 42-50 and Caines, column 6, line 22 et seq. show that the heating conditions of Saito are expected to give the instantly claimed worm-like shape when such graphite/oxyacid compositions are heated to the temperatures of Saito. It is not seen that the heating means of the instant claims gives a different result than that of the patentee via probative evidence that is commensurate in scope with the instant claims and the cited prior art. Furthermore, the instant claims are silent as to the temperature to which the graphite is heated (it is noted that wattage is not sufficient alone since the layout of the microwave and other particulars thereof affect temperature, with microwaves having rotating platforms being a well known instance indicating this fact), which appears to be material to the result of the microwave or radio frequency heating

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as would be clear to anyone who has ever heated anything with a microwave. No evidence is seen that the claimed method of making the graphite makes the instantly claimed products different from those of the patentee though the processes of making the graphites differ in the form of energy applied to the graphites. It would appear that these different energy forms would lead to the same products, particularly given the lack of specificity of the instant claims in establishing any unobviously different structure between the two graphites. See MPEP 2113. See Saito et al., the abstract, which discloses the instantly claimed composites and their barrier properties and electrical conductivity. The intercalation and heating of column 2, lines 59-65 of the patentee is expected to give the same effect as the instantly claimed microwave or radiofrequency heating since all are forms of energy resulting in heating. The fabrication methods of column 4, lines 49-60 are the fabrication steps of the methods of the instant claims 12-15, 19, and 30. It is not seen that the instant method claims require more steps than the claimed fabrication steps. It is not seen that the method steps relating to making the graphite are required by the instant method claims since they appear to only define the graphite “provided” and are not necessary for the processes of fabricating of these claims. Column 4, lines 37-48 encompass the amounts of the instant claim 2. The exemplified resistivities, such as column 5, lines 38-40, and the conductive nature of the composites of the patentee implies the conductivity of the instant claim 14. The particle sizes of the graphites of the patentee fall within those of the instant claims.

The above rejection meets the requirements of an anticipation rejection. There is no probative evidence that is commensurate in scope with the instant claims and the cited prior art that the composite of the cited prior art does not fall within the scope of the instant claims. Again MPEP

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2113 regarding product by process claims is noted. The rejection appears even more correct now that less time in the microwave is required. The applicant has not demonstrated the argued structure implied by the product by process limitations gives an actual structural difference in a manner commensurate in scope with the instant claims and the cited prior art. There is no showing of any structural difference between the prior art composites and those of the instant claims particularly considering the breadth of the instant claims due to lack of recitation of power applied to the microwaved graphite, temperature the graphite reaches, or any other limitations which specifically affect what happens to the microwaved materials. Furthermore, the claims read on further processing such as grinding as does the prior art cited. No evidence presented by the applicant addresses all of these issues. The examiner sees not structural differences that result from microwaving verses the heating of the cited prior art.

The applicant's arguments of 6/29/06 have previously been considered including the declaration of Lawrence T. Drzal. However, there is no comparison data with the prior art graphites discussed above. Furthermore, the graphites of the referenced dissertation appear to have been treated

under very specific conditions as to time and temperatures which are not required of the instant claims nor the prior art cited above. Nor are any of the argued graphite superior properties required of the instant claims. It would appear to be possible to heat graphite to other temperatures for other times at other wattages and obtain the above discussed graphites. The applicant's reference to MPEP 2113 is therefore not persuasive in that it has yet to be demonstrated that microwave heating as broadly encompassed by the instant claims and the above cited prior art gives the "implied structure" argued. It would appear that temperature and

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treatment time would be material to how clean the surface of the graphite gets. This position is therefore maintained.

It remains the examiner's position that the prior art composites fall within the scope of those of the instant claims and that there is not sufficient evidence that the instant claims do not include the prior art composites due to the lack of recitation of parameters important to determining the exact nature of the graphite that results from microwaving verses heating of the cited prior art.

Saito does not specify microwave or radio frequency heating for the time of the instant claims.

It would have been obvious to one of ordinary skill in the art at the time of the instant invention to use the instantly claimed ingredient combinations, processes of mixing these components, and fabricating articles therefrom from the disclosure of the patentee because the patentee encompasses the instantly claimed composites, methods of mixing their components, and methods of fabricating articles with these composites and the composite properties including barrier properties and electroconductivity are stated to be in these composites. No differences are shown to stem from the instantly claimed process steps in a manner commensurate in scope with the instant claims and the cited prior art.

There is no showing of unexpected results nor any difference over the cited prior art due to the instantly claimed microwaving verses the heating of the cited prior art in a manner commensurate in scope with the instant claims and the cited prior art, particularly the lack of recitation of particulars regarding the microwaving that materially affect the product that results from the microwaving including but not limited to temperature the graphite reaches and how long it is at that temperature, shape of the cavity the graphite is in, etc.

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It is expected that the intercalation of the reference at the high temperature that is expected to violently flash off the intercalant will necessarily, inherently give some spacing that is within the scope of the instantly claimed "300 times or more" due to the closeness of the graphene sheets in their non-expanded form, the visible expansion giving huge, by comparison to the non-expanded distances, separation of the graphene sheets, that must be 300 times or more for at least some of the expansion. It is noted that the instant specification teaches that not all of the sheets in the sample give this expansion. See paragraph [0069] noted in the applicant's response. See MPEP 2112 regarding inherency.

The 5/1/09 declaration of L. Drzal has been fully considered but is not sufficient to overcome the instant rejections. There is not probative evidence that the high temperatures, e.g. 1000 C, of Saito does not violently flash off the oxidizing acid. While the mechanisms of heat transfer between microwaving and convection are clearly different, both ultimately result in heat. The instant claims do not specify the particulars of the microwaving, such as cavity size, magnetron arrangement, frequency, power, etc. so as to give the time that it takes the microwaved graphite of the instant claims to reach whatever temperature it reaches, this temperature also is not specified by the instant claims. The 10 kilowatt microwave of the declaration is therefore not commensurate in scope with the instant claims. It is not seen that the acid vapor merely leaks out at 1000 C and does not escape violently via flashing off. The prior art is not limited to the Asbury Expandable Graphite Grade 3772 of the declaration. It is not seen how differences in intercalated graphites affect the results. The declaration does not show that the graphite expanded by convection heating does not have grapheme sheets that have separated by 300 times in accordance with the instantly claimed invention even if not all of the sheets separate by this



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amount per the instant application paragraph [0069], which is taken as indicating that not all of the sheets need to separate by 300 times to meet the instantly claimed limitation. If the separation of the closely packed sheets, prior to expansion, is not relatively large, e.g. 300 times or more, it is expected that the bonds holding the sheets in closely packed form may reform.

The applicant's opinion that one would not use microwaves to heat graphite because the graphite is conductive lacks probative support and is merely opinion. The graphite is not as conductive as metal. Metal is routinely excluded from microwaves due to the arcing noted by the declaration. However, metal is used in some microwave containers, such as microwaved pizza cardboard containers, to give browning of the crust. Metals are expected to have lower energies for the electrons therein to escape. The examiner sees no evidence that the energy of microwave photons can cause the electrons in graphite to escape and give arcing. The energy required to get electrons to escape from graphite is relatively easy to measure. It is well known to the extent that I believe the general concept is what Einstein received his Nobel prize for and the examiner did routine experiments in determining the escape potentials for electrons of various substrates when bombarded with photons of various frequencies in undergraduate physics lab. Thus, the applicant's assertion that microwaves would be expected to cause arcing in graphite is readily determinable and this determination is not seen in probative form. The applicant's conclusion is therefore not supported by probative evidence. Furthermore, it is not seen that the graphite will spark in the presence of the intercalating agents or would have been expected to spark. The Blain reference cited in the following rejections is also noted as contradicting this opinion. The applicant is further directed to the above discussion that microwaving is not required of the instantly claimed inventions which are directed to

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composites, articles, and methods of making things with the already formed expanded graphite. It remains unseen that the microwaving makes a different expanded graphite than that of the cited prior art, considering the scope of the instant claims, particularly regarding the lack of microwaving particulars needed to determine the affects of the microwaves on the graphite.

Arguments relating to the related application 11/361255 are not persuasive because the claims therein are not the same as the instant claims. The last four lines of page 18 of the applicant's response is correct and would make the instant claims allowable. However, as stated above, the examiner cannot see that the expansion of the prior art at 1000 C does not give the instantly claimed 300 times expansion for at least some graphene sheets per the instant specification, paragraph [0069], discussed above. The evidence of page 19, first four lines of the applicant's response is not seen, as noted above. Particularly, Blain, cited in the rejection below, column 5, lines 1-7 refutes this idea. Furthermore, it is the examiner's contention that the claims in the instant application do not require the microwaving, as discussed above. There remains no evidence that is commensurate in scope with the instant claims and the cited prior art that a cleaner surface results from microwaving. This issue has been argued fully in the entire set of the applicant's applications related to microwave expansion of intercalated graphite. These arguments are maintained here also. Particularly, those relating to the lack of particulars of the microwaving process discussed above are noted here.

The applicant's arguments have been fully considered but are not persuasive for the above reasons. This rejection is maintained.

11. Claims 1-4, 7-8, 10-15, 19-20, 22-23, and 25-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Pat. No. 6024900 Saito et al. in view of US Pat. No. 6200915

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Adams et al., US Pre-Grant Publication Number 2002/0114952 Ottinger et al., US Pat. No. 6413601 Blain et al., and US Pat. No. 5164054 Cha et al. US Pat. No. 6555271 Greinke et al., US Pat. No. 6248462 Bonville, and US Pat. No. 5288429 Von Bonin et al. with US Pat. No. 6395199 Krassowski et al. and US Pat. No. 4199628 Caines being cited as evidence that the temperatures of Saito give the instantly claimed "worm-like" structure.

Saito discloses the instantly claimed inventions at the abstract; column 2, lines 50-67; column 3, lines 1-67; column 4, lines 1-67, particularly 22, which falls within the scope of the instant claim 8; column 5, lines 1-67, particularly 22, which falls within the scope of the instant claim 30; and the remainder of the document. The instant claims which are directed to products per se, not the methods of making them appear to be encompassed by the products of Saito because they appear to be the same products as those of the instant claims though the methods of making them differ. It would appear that the resulting products of Saito would fall within the scope of those of the instant claims, particularly considering the lack of details of the instantly claimed processes, even though their process is slightly different. The instant claims and the reference merely use different forms of energy to achieve the same outcome. No difference in resulting products, commensurate in scope with the cited prior art and the instant claims is seen.

Saito discloses a carbon composite material which is a molded material comprising an expanded graphite powder and a thermoplastic resin or a thermosetting resin, wherein the expanded graphite powder is dispersed in the resin, and wherein the expanded graphite powder has an average particle diameter of 5-12 microns and at least 80% of the total particles of the expanded graphite powder have particle diameters of 0.1-20 microns (Col. 2, lines 21-31). The expanded graphite in Saito is obtained by adding

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sulfuric acid with hydrogen peroxide to raw graphite, therein intrinsically forming an expanded graphite precursor, then stirring, and then heating the precursor in an inert gas at a temperature of  $500^{\circ}$  -  $1000^{\circ}$  C (Col. 2, lines 54-65), therein intrinsically implying that the sulfuric acid and the hydrogen peroxide will be vaporized at such high temperatures and the claimed worm-like shape will be obtained as evidenced by Caines and Krassowski cited above. The thermoplastic resins that may be used include polyethylene, polystyrene, polypropylene, polymethyl methacrylate, polyethylene terephthalate, polybutylene terephthalate, polyethersulfone, polycarbonate, polyoxamethylene, polyamide, polyimide, polyamideimide, polyvinyl alcohol, polyvinyl chloride, fluororesin, polyphenylsulfone, polyether ether ketone, polysulfone, polyether ketone, polyarylate, polyetherimide, polymethylpentene and the like (Col. 4, lines 9-18). The thermosetting resin that may be used includes polycarbodiimide resin, phenolic resin, furfuryl alcohol resin, cellulose, epoxy resin, urea resin, melamine resin and the like (Col. 4, lines 19-24). The thermosetting resin or the thermoplastic resin may be used in the form of a powder or a solution in an appropriate solvent (col. 4, lines 25-27). A process for producing the carbon composite molded material is disclosed by Saito, wherein the expanded graphite and the thermoplastic or thermosetting resin are mixed and dispersed together and then the resulting mixture is pressure-molded at room temperature to  $400^{\circ}$  C (Col. 2, lines 32-49), therein intrinsically curing the resin.

The carbon composite molded material has superior gas non-permeability and electroconductivity (Col. 8, lines 1-9), therein intrinsically implying that the expanded graphite present in the carbon composite molded material is present in an amount so

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that the composite material is conductive. The amount ratio of expanded graphite and the resin is 10-1000 parts by weight of resin per 100 parts by weight of expanded graphite powder (Col. 4, lines 38-48), resulting in a broad range of 9.1% - 90% by weight of expanded graphite in the carbon composite material, therein intrinsically providing less than 50% by volume of expanded graphite the composite material. However, it is to be noted that a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985). See M.P.E.P. § 2144.05. Therefore, it would have been obvious to one of ordinary skill in the art to add less than 8% by weight of the expanded graphite to the carbon composite material, as presently recited according to the instant claim 20.

Adams, which is drawn to silicone-based coating compositions having reinforcing fillers (see Abstract), discloses laminar fillers having plate-like shapes, wherein the diameter of the plate is from 5 to 500 microns and the thickness is 1 to 100 Angstroms, and wherein these fillers include expanded graphite (Col. 6, lines 58-67 and Col. 7, lines 1-17). Adams also discloses that the laminar filler- expanded graphite- having a height or thickness which is sufficiently smaller than the width and length can be agglomerated by clustering several of these laminar particles (Col. 7, lines 3-10). Although Adams is silent with respect to the importance of such a laminar structure of the expanded graphite, Ottinger, which is drawn to a synthetic resin-impregnated body made of

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expanded graphite (Page 1, paragraph [0002]), discloses that the platelet shaped (i.e., laminar) expanded graphite particles slide in over one another becoming interlocked so as to never be released without destruction (Page 3, paragraph [0036]). It would have been obvious to one of ordinary skill in the art at the time of the instantly claimed invention to use the laminar plate-like shaped expanded graphite with specified dimensions as disclosed by Adams and Ottinger in Saito's composition because the platelet shaped (i.e., laminar) expanded graphite particles slide in over one another becoming interlocked so as to never be released without destruction giving rise in the composite material a porous graphite framework or network which has good electrical as well as thermal conductivity due to the good contacts between the graphite platelets, wherein these properties are not affected by impregnation with synthetic resin (Col. 3, paragraph [0036]), thereby obtaining the invention as set forth in the presently cited claims.

The difference between Saito in view of Adams and Ottinger and the presently claimed invention is the requirement that the expanded graphite has been formed in a radiofrequency wave applicator by heating a graphite precursor with radiofrequency waves or the expanded graphite is made by microwave or RF heating and that the polymer and the expanded graphite have been heated together with a radiofrequency wave applicator.

Blain, which is drawn to a thermal insulating device (Col. 1, lines 7-15), discloses the exfoliation of graphite flakes by exposing them to a heat sources such as microwave or radio frequency radiation (Col. 5, lines 1-7). Although Blain is silent with respect to using a radiofrequency wave applicator, Cha, which is drawn to the use of

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radiofrequency energy as a non-chemical catalyst (Col. 1, lines 11-13), discloses that a traveling wave applicator or waveguide is used to transfer radiofrequency energy (Col. 6, lines 28-34). It would have been obvious to one of ordinary skill in the art at the time of the instantly claimed invention to use a heat source such microwave or radiofrequency radiation for the exfoliation of graphite as disclosed by Blain and Cha in Saito's composite material because a wave applicator can be used to transfer radiation energy inside a reactor (Col. 6, lines 28-34), therein maintaining confinement during these processes, thereby obtaining the invention as set forth in the presently cited claims and microwave or other radiofrequency radiation will ultimately result in the heat required by Saito to treat the graphite thereby giving the same product ultimately. In other words, microwaves or radio waves are conventional means for applying the heat required by the temperatures disclosed by Saito for exfoliating the graphite of Saito. It would have been obvious to one of ordinary skill in the art at the time of the instantly claimed inventions to use the instantly claimed wattages and times because coupled with the electromagnetic radiation source's particulars, such as size, shape, wave-guide particulars, etc., these parameters will give predictable results such as temperature achieved, which as long as the temperatures required by Saito are achieved, are not seen as giving different final products nor unexpected results.

The difference between Saito in view of Adams and Ottinger and the presently claimed invention is the requirement that the anode in a battery has a finely divided microwave or RF expanded graphite.

Greinke, which is drawn to the production of an anode in a battery (Col. 1, lines 5-6), discloses an anode is produced by particles of exfoliated graphite (Col. 3, lines 37-

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50). It would have been obvious to one of ordinary skill in the art to use exfoliated or expanded graphite in an anode of a battery as disclosed by Greinke because as disclosed by Saito in view of Adams and Ottinger, expanded graphite is a good conductor of electricity (see page 3, paragraph [0036] of Ottinger), it would have therefore been obvious to one of ordinary skill in the art at the time of the instantly claimed invention to use a good conductor of electricity to form an anode in a battery for proper functioning, thereby obtaining the invention as set forth in the presently cited claims.

The difference between Saito in view of Adams and Ottinger and the presently claimed invention is the requirement that the substrate having a catalytic material deposited thereon wherein the catalytic material is used for the conversion of an organic compound to hydrogen, the substrate having a finely divided microwave or RF expanded graphite having single particles with a length less than about 200 microns and a thickness of less than about 0.1 microns.

Bonville, which is drawn to a fuel cell assembly (Col. 1, lines 7-11), discloses that hydrocarbon fuels may be converted into hydrogen (Col. 2, lines 24-34) and that to accomplish this efficiently a fuel cell is described as having an anode catalyst formed from porous graphite (Col. 4, lines 10-20), wherein the anode catalyst corresponds to the graphite substrate having a catalyst deposited thereon. It would have been obvious to one of ordinary skill in the art at the time of the instantly claimed invention to make a substrate-catalyst as described in Bonville by using Saito in view of Adams and Ottinger's expanded graphite because expanded graphite is a good conductor of heat and electricity (see



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page 3, paragraph [0036] of Ottinger), it would have therefore been obvious to use a good conductor of heat and electricity to perform high temperature catalytic conversion of hydrocarbons into hydrogen, thereby obtaining the invention as set forth in the presently cited claims.

The difference between Saito in view of Adams and Ottinger and the presently claimed invention is the requirement that the expanded graphite is grafted with an acrylamide.

Von Bonin, which is drawn to the production of mouldings from expanded graphites (Col. 1, lines 5-7), discloses water-containing mixtures including acrylamide in the moist preparation of expandable graphite (Col. 3, lines 8-15). It would have been obvious to one of ordinary skill at the time of the instantly claimed invention in the art to use acrylamide with expanded graphite because acrylamide has an adhesive and thickening effect on the graphite (Col. 3, lines 8-15), thereby obtaining the invention as set forth in the presently cited claims.

It is clear that the composites of the instant claims are to contain finely divided expanded graphite (instant specification, particularly sections [0014]-[0015]) which has been subject to grinding (section [0061]). As such, the composites of the instant claims fall within the scope of those of the patentee. The patentee's graphite has been "expanded". No evidence is seen that this does not fall within the scope of making the worm-like moieties of the instant claims since the patentee's expanded graphite is generally made by the same process though a different heat source is used. See the above cited sections of Saito et al.. The graphite of the patentee is then

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ground to very small particle sizes that fall within the scope of those described in the instant specification. It is noted that the instantly claimed microwaves or radiowaves are denoted with "Preferably". The instant claims do not recite any temperatures nor other limitations that show that the final graphite of the instant claims is different than that of the cited prior art. It is expected that the expansion of the patentee necessarily and inherently gives the instantly claimed "worm-like shape" and expands the graphite perpendicular to a basal piece of the graphite since the process of the patentee is substantially the same as that of the instant claims. It is believed that this is the definition of "expanded graphite" by the process of the patentee. See MPEP 2112-2113. It is further noted that the instant claims read on further grinding the expanded graphite, which will eliminate the worm-like structures to give the particles described in the instant specification and by the patentee. There is no evidence that the temperatures of the patentee do not "remove the chemical".

This rejection is maintained for the reasons stated in paragraph 10 above as they relate to those references that are common to this rejection and the rejection of paragraph 10 above and for the reasons stated in this paragraph. There is no showing of unexpected results nor any difference over the cited prior art due to the instantly claimed microwaving verses the heating of the cited prior art in a manner commensurate in scope with the instant claims and the cited prior art, particularly the lack of recitation of particulars regarding the microwaving that materially affect the product that results from the microwaving including but not limited to temperature the graphite reaches and how long it is at that temperature, shape of the cavity the graphite is in, etc.

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It is expected that the intercalation of the reference at the high temperature that is expected to violently flash off the intercalant will necessarily, inherently give some spacing that is within the scope of the instantly claimed "300 times or more" due to the closeness of the graphene sheets in their non-expanded form, the visible expansion giving huge, by comparison to the non-expanded distances, separation of the graphene sheets, that must be 300 times or more for at least some of the expansion. It is noted that the instant specification teaches that not all of the sheets in the sample give this expansion. See paragraph [0069] noted in the applicant's response. See MPEP 2112 regarding inherency.

The 5/1/09 declaration of L. Drzal has been fully considered but is not sufficient to overcome the instant rejections. There is not probative evidence that the high temperatures, e.g. 1000 C, of Saito does not violently flash off the oxidizing acid. While the mechanisms of heat transfer between microwaving and convection are clearly different, both ultimately result in heat. The instant claims do not specify the particulars of the microwaving, such as cavity size, magnetron arrangement, frequency, power, etc. so as to give the time that it takes the microwaved graphite of the instant claims to reach whatever temperature it reaches, this temperature also is not specified by the instant claims. The 10 kilowatt microwave of the declaration is therefore not commensurate in scope with the instant claims. It is not seen that the acid vapor merely leaks out at 1000 C and does not escape violently via flashing off. The prior art is not limited to the Asbury Expandable Graphite Grade 3772 of the declaration. It is not seen how differences in intercalated graphites affect the results. The declaration does not show that the graphite expanded by convection heating does not have grapheme sheets that have separated by 300 times in accordance with the instantly claimed invention even if not all of the sheets separate by this

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amount per the instant application paragraph [0069], which is taken as indicating that not all of the sheets need to separate by 300 times to meet the instantly claimed limitation. If the separation of the closely packed sheets, prior to expansion, is not relatively large, e.g. 300 times or more, it is expected that the bonds holding the sheets in closely packed form may reform.

The applicant's opinion that one would not use microwaves to heat graphite because the graphite is conductive lacks probative support and is merely opinion. The graphite is not as conductive as metal. Metal is routinely excluded from microwaves due to the arcing noted by the declaration. However, metal is used in some microwave containers, such as microwaved pizza cardboard containers, to give browning of the crust. Metals are expected to have lower energies for the electrons therein to escape. The examiner sees no evidence that the energy of microwave photons can cause the electrons in graphite to escape and give arcing. The energy required to get electrons to escape from graphite is relatively easy to measure. It is well known to the extent that I believe the general concept is what Einstein received his Nobel prize for and the examiner did routine experiments in determining the escape potentials for electrons of various substrates when bombarded with photons of various frequencies in undergraduate physics lab. Thus, the applicant's assertion that microwaves would be expected to cause arcing in graphite is readily determinable and this determination is not seen in probative form. The applicant's conclusion is therefore not supported by probative evidence. Furthermore, it is not seen that the graphite will spark in the presence of the intercalating agents or would have been expected to spark. The Blain reference cited in the following rejections is also noted as contradicting this opinion. The applicant is further directed to the above discussion that microwaving is not required of the instantly claimed inventions which are directed to

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composites, articles, and methods of making things with the already formed expanded graphite. It remains unseen that the microwaving makes a different expanded graphite than that of the cited prior art, considering the scope of the instant claims, particularly regarding the lack of microwaving particulars needed to determine the affects of the microwaves on the graphite.

Arguments relating to the related application 11/361255 are not persuasive because the claims therein are not the same as the instant claims. The last four lines of page 18 of the applicant's response is correct and would make the instant claims allowable. However, as stated above, the examiner cannot see that the expansion of the prior art at 1000 C does not give the instantly claimed 300 times expansion for at least some graphene sheets per the instant specification, paragraph [0069], discussed above. The evidence of page 19, first four lines of the applicant's response is not seen, as noted above. Particularly, Blain, cited in the rejection below, column 5, lines 1-7 refutes this idea. Furthermore, it is the examiner's contention that the claims in the instant application do not require the microwaving, as discussed above. There remains no evidence that is commensurate in scope with the instant claims and the cited prior art that a cleaner surface results from microwaving. This issue has been argued fully in the entire set of the applicant's applications related to microwave expansion of intercalated graphite. These arguments are maintained here also. Particularly, those relating to the lack of particulars of the microwaving process discussed above are noted here.

The applicant's arguments have been fully considered but are not persuasive for the above reasons. This rejection is maintained.

12. The claim recitation of "worm-like" has been considered regarding 112 second paragraph issues. It is a term of art that the ordinary skilled artisan would understand, based on the

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examiner's search of the prior art. US Pat. Nos. 6395199 and 4199628, column 6, line 24 recite this term and describe it regarding the expanded graphite art. The recitation of "worm like" at section [0069] of the applicant's specification is noted. See MPEP 2173.05(b): regarding

"The term "or like material" in the context of the limitation "coke, brick, or like material"

was held to render the claim indefinite since it was not clear how the materials other than coke or brick had to resemble the two specified materials to satisfy the limitations of the claim. Ex parte Caldwell, 1906 C.D. 58 (Comm'r Pat. 1906)." However, the term is well defined in this instance and the ordinary skilled artisan would know what "worm-like" means regarding the expanded graphite art.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patrick D. Niland whose telephone number is 571-272-1121. The examiner can normally be reached on Monday to Friday from 10 to 5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Wu, can be reached on 571-272-1114. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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/Patrick D Niland/  
Primary Examiner  
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